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**DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL PROTECTION**

**Carson City Office
333 West Nye Lane
CARSON CITY, NEVADA 89710**

WTS - 37

**GUIDANCE DOCUMENT FOR DESIGN OF WASTEWATER
DETENTION BASINS**

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Information from the items listed below shall be presented as a minimum in an application for a holding pond. The Bureau of Water Pollution Control reserves the right to require further information as needed. The Nevada Division of Water Resources (687-4380) must approve any basin with a depth greater than 20 feet or containing more than 20 AF.

This document is solely intended as guidance, and is not regulation. It shall not replace best professional engineering judgement in the design of a wastewater detention basin.

KEY WORDS:

NDEP: Nevada Division of Environmental Protection

ASTM: American Society for Testing and Materials

I. SITE CHARACTERIZATION DATA REQUIRED

- A. Topographical Map of the site depicting surrounding water courses, dwelling units, earthquake fault lines, springs, and wells. Contour intervals shall be five feet.
- B. Boring logs (average of one per two acres, two logs minimum) from surface to groundwater table (or a predetermined level after NDEP consultation). Logs should be prepared by a qualified professional. The log should detail the presence of confining layers, soil that may liquefy, and pervious strata. Soil permeability shall be evaluated.

The groundwater gradient and direction, depth to groundwater, and groundwater quality shall be provided.

- C. Watershed map of the site which depicts the 100 year flood plain and run-off channels.
- D. Direction of prevailing winds shall be provided.

II. GENERAL DETENTION BASIN CONSTRUCTION DETAILS (applicable to all basins)

- A. Interior embankments shall be no steeper than 3:1 (horizontal to vertical).
- B. Liner leakage shall be equivalent to 12 inches of material with a permeability coefficient of 1×10^{-7} cm/sec.
- C. Basin bottom shall be level

If the proposed leak detection system warrants a gradual slope to a collection sump, the basin bottom shall be allowed to have a gradual slope.

- D. Top of dike shall be a minimum of 8 feet wide.
- E. Basin geometry should preferably be either square, round, or rectangular. If rectangular, the side lengths shall be no longer than 3 times the side width. Other basin geometry's are acceptable.
- F. A freeboard of 3 feet is required for all large basins (greater than 1 acre). A freeboard of 2 feet may be acceptable for smaller basins (1 acre or less), if it can be determined that wave action will not be a problem.
- G. The basin must withstand, without release, the 25 year, 24 hour storm event at the site.
- H. Plans for protection from floodwater must be presented. The basin must be designed to withstand the run-off generated from the 24-hour storm event with a 100-year recurrence interval. The basin should remain operational after such an event, with no structural damage.

The Designer shall attempt to **not** locate any ponds within the 100-year flood plain (NAC 445A.285).

- I. A staff gage must be present in each basin. Length intervals shall be marked in units of tenths of a foot or meter, and be easily readable.
- J. A plan for leak detection must be presented. Examples of acceptable leak detection plans include double liner designs, moisture sensing systems installed beneath the liner, or downgradient monitoring wells. Other innovative plans for leak detection will be reviewed by NDEP on a case by case basis.
- K. A water balance demonstrating storage capacity of the basin within the required freeboard shall be presented. This balance shall incorporate local area figures for pond evaporation and average precipitation.

- L. Inlet piping must be above the basin liner and adequate erosion measures at the discharge point must be presented. Examples of adequate erosion control measures include rip-rap beneath the inlet piping, concrete splash pads, or wear sheets for geomembrane liners.
- M. Seepage collars must be installed to junctions where piping exits and enters the basin dike.
- N. Odor control plans (if required). This may include providing aeration to the basin(s).
- O. The chemical compatibility of the liner material with the contained wastewater must be presented.

III. ADDITIONAL DESIGN ITEMS FOR EARTHEN LINED BASINS

- A. The particle gradation (sieve analysis), soil density, and the atterberg limits (liquid limit, plastic limit and shrinkage limit) of the soil liner material shall be provided to the **Division for review and approval prior to construction.**

Soil Density Testing - Test Method ASTM 1556

Soil Gradation

Atterberg Limits - Test Method ASTM 4318

- B. The liner shall be compacted to 90% modified proctor within 2% of optimum moisture.
- C. Permeability testing of the compacted liner shall be in accordance with ASTM 5084. The number of tests and test locations must receive NDEP approval prior to implementation.
- D. Minimum liner thickness shall be 12 inches, with installation of no larger than 6 inch lifts.
- E. The inside berms shall be protected from erosion by rip-rapping or other acceptable measures.
- F. A plan for protection of the liner from vegetation, desiccation, and burrowing animals must be presented.

IV. DESIGN ITEMS FOR GEOMEMBRANE LINER SYSTEMS

- A. The following liner material specifications and corresponding ASTM test results shall be submitted:

1.> Thickness - Test Method ASTM D3767

Minimum thickness shall be 60 mil for a primary liner.

(Note: Reclaimed water storage ponds (golf courses, etc.) may utilize PVC liners with a minimal thickness of 30 mils provided it is protected from UV degradation)

2.> Permeability - Test Method ASTM D96

Maximum permeability shall be equivalent to 12 inches of material with a permeability of 1×10^{-7} cm/sec. Generally will be 1×10^{-11} cm/sec to 1×10^{-13} cm/sec.

3.> Polymer Type - HDPE, VLDPE, PVC, or other

4.> Ultraviolet Light Resistance - Test Method ASTM D3334

5.> Chemical Resistance - EPA Test Method 9090

(Data must demonstrate that the liner is chemically compatible with the wastewater it is to contain)

6.> Puncture Resistance - Test Method ASTM D2582 or ASTM D3787

- B. Plan for protection of the liner from ice damage, temperature extremes, wind uplift, oxidation, and sharp objects shall be presented. An example of a method of protection is to provide 12 inches of soil cover over the liner.
- C. If gas generation in the subbase is a potential, a plan to remove the gas beneath the liner must be presented.
- D. Supporting geotechnical data on the foundation and slope stability shall be submitted.
- E. Details on liner anchoring and pipe penetration.
- F. Quality control/quality assurance reports on the liner installation shall be provided in a installation verification report. This document shall include results of all field tests conducted on the liner, including:

1.> Seam Testing - ASTM Test Methods

2.> Tear Resistance - ASTM Test Methods

ASTM TEST METHODS ARE AVAILABLE BY CALLING ASTM AT 610832-9500